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Smw 3-9-04

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appellants :	Anthony J. Ruggiero	Docket No. :	IL-10610
Serial No. :	09/827,454	Art Unit :	2633
Filed :	April 6, 2001	Examiner	Christina Y. Leung
For :	Remotely-Interrogated High Data Rate Free Space Laser Communications Link		

TRANSMITTAL OF BRIEF ON APPEAL
(PATENT APPLICATION - 37 CFR 192)

Transmitted herewith in **triplicate** is the **BRIEF ON APPEAL** in this application with respect to the Notice of Appeal filed on November 13, 2003.

The item(s) checked below are appropriate:

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1. STATUS OF APPLICANT

This application is on behalf of

- ☐ other than a small entity.
- ■ a small entity.
  A verified statement
  - ☐ is attached
  - ■ already filed.

2. FEE FOR FILING APPEAL BRIEF

Pursuant to 37 CFR 1.17(e) the fee for filing the Appeal Brief is:

- ■ small entity $165.00
- ☐ other than a small entity $330.00

Appeal Brief fee due **$165.00**

CERTIFICATE OF MAILING/TRANSMISSION (37 CFR 1.8a)

I hereby certify that this correspondence is, on the date shown below, being:

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3. **EXTENSION OF TIME**

❑ Applicant petitions for an extension of time under 37 CFR 1.136

Calculation of extension fee (37 CFR 1.17(a)-(d)):

	Total months requested	Fee for other than small entity	Fee for small entity
☐	one month	$110.00	$55.00
■	two month	$420.00	$210.00
☐	three month	$950.00	$475.00
☐	four month	$1,480.00	$740.00
☐	five month	$2010.00	$1005.00
		Fee	**$210.00**

4. **FEE PAYMENT**

■ Charge Account No. 12-0695 in the amount of **$375.00**.

■ **Charge Account No. 12-0695 for any additional extension and/or fee required or credit for any excess fee paid.**

Date: 2/20/04

Michael C. Staggs
Agent for Applicant
Registration No. 50,938
Tel. No. (925) 422-3682

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appellants :	Anthony J. Ruggiero	Docket No. :	IL-10610
Serial No. :	09/827,454	Art Unit :	2633
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Commissioner for Patents
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I hereby certify that the following *attached* correspondence, **all in triplicate**, comprising:

1. Transmittal of Brief on Appeal (2 pages) (in triplicate)
2. Brief of Appeal (24 pages) (in triplicate)
3. Appendix I (Claims on Appeal) (9 pages) (in triplicate)
4. Appendix II (Drawings) (10 sheets) (in triplicate)
5. Return postcard (original only)

is being deposited with the United States Postal Service "Express Mail Post Office to addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to Mail Stop Appeal Brief-Patents, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

April Masluk
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April Masluk
(Signature of person mailing paper or fee)

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FEB 24 2004
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#17 Appeal Brief
SMW 3-9-04

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Appellants :	Anthony J. Ruggiero	Docket No. :	IL-10610
Serial No. :	09/827,454	Art Unit :	2633
Filed :	April 6, 2001	Examiner	Christina Y. Leung
For :	Remotely-Interrogated High Data Rate Free Space Laser Communications Link		

BRIEF ON APPEAL

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Commissioner for Patents
Alexandria, VA 22313-1450

Attention: Board of Patent Appeals and Interferences

Dear Sir:

APPEAL BRIEF (37 C.F.R. § 1.192)

Appellant hereby appeals to the Board of Patent Appeals and Interferences from the final rejection of claims 1-49 mailed May 5, 2003. On November 13, 2003 a timely Notice of Appeal was filed.

Accordingly, Appellant respectfully requests that this Brief be fully considered by the Board and that the Examiner's rejection of the claims be reversed for the reasons stated herein. This brief is transmitted in triplicate per 37 C.F.R. § 1.192. Accompanying this communication is a petition to extend the prosecution on this matter for 2 months and the appropriate fee.

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I. REAL PARTIES IN INTEREST

The real party in interest is: The Regents of the University of California and the United States of America as represented by the United States Department of Energy (DOE) by virtue of an assignment by the inventor as duly recorded in the Assignment Branch of the U.S. Patent and Trademark Office.

II. RELATED APPEALS AND INTERFERENCES

Appellant is unaware of any related appeals or interferences which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

III. STATUS OF CLAIMS

The application as originally filed contained 44 claims.

By Amendment mailed February 22, 2002, claims 1, 3, 10, 11, 18, 22, 24, 25, 34, 38, 39, 40, 41 and 42 were amended and claims 45 – 49 were added.

By Amendment, as a submission for a Request for Continued Examination (RCE), mailed August 21, 2002, claims 1, 18, 22, 24, 34, 35, 36, 40, 41 and 42 were amended.

By Amendment, mailed February 20, 2003, claim 18 was amended to correct for an inadvertent typographical error of a element so as to provide for antecedent basis of dependent claim 21.

The claims on appeal are claims 1-49 and are reproduced in Appendix A.

IV. STATUS OF AMENDMENTS

No amendments have been filed in response to the final office action dated May 23, 2003. All prior amendments have been entered.

V. SUMMARY OF INVENTION

The invention defined by the claims on appeal is described below with citations to pages and lines of the specification. This is done to comply with Section 1206 of the MPEP and is not to be construed as limiting the claimed invention.

The present invention comprises a system and method of remotely extracting information from a communications station by incorporating broad area intra-cavity phase conjugators by interrogation with a power beam from a transceiver. Nonlinear phase conjugation of the beam results in a high power encoded return beam that automatically tracks the input beam and is corrected for atmospheric distortion. Intracavity non-degenerate four wave mixing is used in the broad area broad area device of the present invention to produce the return beam.

In non-generative four wave mixing, such as that taught by Appellant, a probe beam is injected having a frequency, into two counter-propagating pump beams with a predetermined angle, wherein the phase conjugate signal counter-propagating to the incident probe beam is generated as a result of the pump beam diffraction from the spatial grating of the carrier density caused by the interference between the other pump and probe beams, and the phase conjugate signal will be generated at a frequency not equal to the probe beam frequency. In Appellant's invention, this four wave mixing process occurs "intracavity", i.e., within the claimed broad area device.

Broad area is an important claimed limitation described by Appellant in the specification on page 6, lines 16-18. For example, Appellant states, "'broad area' will be used herein to indicate that the micro-phase conjugators are large aperture phase conjugators in a semiconductor device. An aperture may be defined as the acceptance opening or input of a phase conjugate system.....Broad area also indicates that the micro-phase conjugators are multimode (spatially)." Moreover, on page 11, lines 11-25, Appellant further describes the claimed broad area device by

comparing conventional four wave mixing in one dimensional systems with Appellant's broad area system. For example, Appellant states, "commercial broad area diodes are designed as thin rectangular gain stripes that are nominally 1000 to 2000μm long with 100 to 300μm wide by 1 to 2μm high emitter apertures." It is important to note that such conventional devices spatially filter an atmospherically aberrated input beam, destroying the spatial information required to produce a spatially phase conjugated retro-beam. Because conventional devices destroy spatial information, such devices do not correct for atmospheric distortions. By contrast, Appellant's claimed device has an aperture defined not by the thin gain strip, but by the broad area defined from the top (i.e., from a top down perspective) of the RM-PCM 310 device as shown in Figure 3B, (see attached figures), of the application. On page 5, lines 17-25, Appellant states why such a broad area intra-cavity device of the present invention is capable of resolving atmospheric distortions, "For high fidelity phase conjugation, the aperture of the broad area semiconductor laser diode 334 should resolve substantially all (or a "substantial portion" of) the spatial components of the input wavefront of the interrogating beam. ("Substantial portion" may be defined as greater than 60% and ideally greater than 80%). In other words, the degree of compensation depends on whether the broad area semiconductor laser diode aperture is large enough, and the field of view (or more precisely the number of spatial modes) is sufficient to resolve the atmospheric aberrations."

Accordingly, Appellant's two-dimensional claimed broad area intra-cavity phase conjugator is capable of resolving a substantial portion of the spatial components of the input waveform of the interrogating beam to enable correction for an atmospherically aberrated beam.

In addition to attached Figures 1A-1B, Figure 2, Figures 3A-3D, Figure 4, Figures 5A-5F, and Figures 6A-6B, independent claims 1, 18, 22, 24, 34, 35, 36, 40, 41,

and 42 are set forth hereinafter to further illustrate the principle features of the above-described method and system for a Remotely-Interrogated High Data Rate Free Space Laser Communications Link.

Claim 1 describes, "a system comprising: a transceiver constructed to transmit an interrogating beam; a communications station capable of receiving said interrogating beam; and said communications station having a plurality of broad area intra-cavity phase conjugators arranged in an array."

Claim 18 describes, "a system comprising: a transceiver constructed to transmit an interrogating beam; and a communication station capable of receiving said interrogating beam; and said communication station having a broad area, intra-cavity phase conjugator with a top electrode, wherein an aperture is located in said top electrode."

Claim 22 describes, "a system comprising: a transceiver constructed to transmit an interrogating beam; a communication station capable of receiving said interrogating beam; and said communication station having a broad area, intra-cavity phase conjugator which is a VCSEL structure."

Claim 24 describes, "an optical interconnection system comprising: a fiber optic device constructed to transmit an interrogating beam; and a micro-mirror adapted to receive said interrogating beam and transmit the beam to a predetermined broad area intra-cavity phase conjugator."

Claim 34 describes, "a system comprising: a means for transmitting and receiving an interrogating beam; a communication station operatively coupled to said transmitting and receiving means, wherein the station includes a broad area intracavity phase conjugator for returning a phase conjugate beam to said transmitting and receiving means."

Claim 35 describes, "a method comprising: transmitting an interrogating beam from a transceiver; receiving said interrogating beam at a communication

station; producing a phase conjugate beam of said interrogating beam by a broad area intracavity phase conjugator; encoding data onto said phase conjugate beam and pumping an encoded phase conjugate reflectivity by nondegenerate four wave mixing; and transmitting said encoded phase conjugate beam back to the transceiver."

Claim 36 describes, "a method comprising: transmitting an interrogating beam from a transceiver;receiving said interrogating beam at an array of phase conjugators; producing a phase conjugate beam of said interrogating beam, wherein each of said phase conjugators arranged in said array comprise a broad area intracavity micro phase conjugator; modulating data onto said phase conjugate beam; and transmitting said phase conjugate beam to said transceiver."

Claim 40 describes, "a method comprising: transmitting an interrogating beam from a transceiver; receiving said interrogating beam at an array of broad area intra-cavity phase conjugators through apertures located in the top electrodes of the phase conjugators; modulating data onto a phase conjugate beam; and transmitting the phase conjugate beam to said transceiver."

Claim 41 describes, "a method comprising: transmitting an interrogating beam from a transceiver; receiving said interrogating beam at an array of broad area intra-cavity phase conjugators and resolving a substantial portion of the spatial components of the input wavefront of the interrogating beam; modulating data onto a phase conjugate beam; and transmitting the phase conjugate beam to said transceiver."

Claim 42 describes, "a method of providing an optical interconnect comprising: transmitting an interrogating beam from a fiber optic device; receiving said interrogating beam at a micro-mirror across free space; transmitting a second beam from said micro-mirror; and producing a phase conjugate beam of the second beam received from said micro-mirror by a broad area intracavity predetermined phase conjugator."

VI. ISSUES

The following issues are presented for appeal:

A. Whether claims 1-7, 9-14, 16, 17, 40, 41, and 45 would have been obvious under 35 U.S.C. §103(a) over Akkapeddi (US 4,949,056) in view of Vasil'ev et al. ("Phase-conjugation broad area twin-contact semiconductor laser," Applied Physics letters, July 1997) and Pepper et al. (US 5,038,359 A).

B. Whether claims 8 and 15 would have been obvious under 35 U.S.C. §103(a) over Akkapeddi (US 4,949,056) in view of Vasil'ev et al. ("Phase-conjugation broad area twin-contact semiconductor laser," Applied Physics letters, July 1997) and Pepper et al. (US 5,038,359 A) as applied to claim 1 and further in view of Watanabe (US Patent No. 5,920,588 A).

C. Whether claims 18, 19, and 21 would have been obvious under 35 U.S.C. §103(a) over Akkapeddi (US 4,949,056) in view of Vasil'ev et al. ("Phase-conjugation broad area twin-contact semiconductor laser," Applied Physics letters, July 1997) and Pepper et al. (US 5,038,359 A).

D. Whether claims 20, and 46-49 would have been obvious under 35 U.S.C. §103(a) over Akkapeddi (US 4,949,056) in view of Vasil'ev et al. ("Phase-conjugation broad area twin-contact semiconductor laser," Applied Physics letters, July 1997) as applied to claim 1 and further in view of Watanabe (US Patent No. 5,920,588 A).

E. Whether claims 22 and 23 would have been obvious under 35 U.S.C. §103(a) over Akkapeddi (US 4,949,056) in view of Vasil'ev et al. ("Phase-conjugation broad area twin-contact semiconductor laser," Applied Physics letters, July 1997) and Damen et al. (US Patent No. 5,675,436 A).

F. Whether claims 24 and 26-33 would have been obvious under 35 U.S.C. §103(a) over Watanabe (US Patent No. 5,920,588 A) in view of Vasil'ev et al. ("Phase-conjugation broad area twin-contact semiconductor laser," Applied Physics letters, July 1997) and MacDonald (US Patent No. 5,519,723 A).

G. Whether claim 25 would have been obvious under 35 U.S.C. §103(a) as being unpatentable over Watanabe et al (US Patent No. 5,920,588 A) in view of Vasil'ev et al. ("Phase-conjugation broad area twin-contact semiconductor laser," Applied Physics letters, July 1997) and MacDonald (US Patent No. 5,519,723 A) as applied to claim 24 and further in view of Damen et al. (US Patent No. 5,675,436 A).

H. Whether claims 34 and 35 would have been obvious under 35 U.S.C. §103(a) over Sharp et al. (US Patent No. 5,317,442 A) in view of Vasil'ev et al. ("Phase-conjugation broad area twin-contact semiconductor laser," Applied Physics letters, July 1997).

I. Whether claims 36-39 would have been obvious under 35 U.S.C. §103(a) over Sharp et al. (US Patent No. 5,317,442 A) in view of Pepper et al. (US 5,038,359 A) and Vasil'ev et al. ("Phase-conjugation broad area twin-contact semiconductor laser," Applied Physics letters, July 1997).

J. Whether claims 42-44 would have been obvious under 35 U.S.C. §103(a) over Pepper et al. (US 5,038,359 A) in view of Vasil'ev et al. ("Phase-conjugation broad area twin-contact semiconductor laser," Applied Physics letters, July 1997).

VII. GROUPING OF CLAIMS

Claims 1-7, 9-14, 16, 17, 40, 41, and 45 stand or fall together for the reasons developed below. Claims 8 and 15 stand or fall together for reasons developed in the arguments below. Claims 20 and 46-49 stand or fall together for reasons developed in the arguments below. Claims 22 and 23 are claims that have different scope and stand or fall together for reasons developed in the arguments below. Claims 24, and 26-33 are claims that stand or fall together for reasons developed in the arguments below. Claim 25 stands or falls alone for reasons developed in the arguments below. Claims 34 and 35 are claims that stand or fall together for reasons developed in the arguments below. Claims 36-39 are claims that stand or fall together for reasons developed in the

arguments below. It is also submitted that claims 42-44 are claims that stand or fall together for reasons developed in the arguments below.

VIII. ARGUMENTS

A. Appellant's claims 1-7, 9-14, 16, 17, 40, 41, and 45 are Not Obvious over Akkapeddi in view of Vasil'ev et al. and Pepper et al.

Claims 1-7, 9-14, 16, 17, 40, 41, and 45 stand rejected under 35 U.S.C. §103(a) as obvious over Akkapeddi (US 4,949,056) in view of Vasil'ev et al. ("Phase-conjugation broad area twin-contact semiconductor laser," Applied Physics letters, July 1997) and Pepper et al. (US 5,038,359 A). In support of the rejection of the broadest claim (claim 1), the Examiner stated that Akkapeddi discloses the instant claimed invention except for Appellant's claimed broad area intra-cavity phase conjugators arranged in an array. The Examiner stated that, Vasil'ev et al. teaches a broad area, intra-cavity phase conjugator, which may be used in a system to produce a phase conjugate beam such as the system disclosed by Akkapeddi. In addition, the Examiner stated that Pepper et al teach another type of phase conjugator, but also further suggests that phase conjugators may be arranged in an array. The Examiner further stated that, "it would have been obvious to use the intra-cavity phase conjugator taught by Vasil'ev et al in the system disclosed by Akkapeddi...and to further arrange the phase conjugators in an array as taught by Pepper et al. to provide a broader area for producing phase conjugation."

A1. No Suggestion or Motivation Exists in the Art for Combining or Modifying the Cited References

Appellant respectfully submits that the 103(a) rejection is improper for want of prima facie support of obviousness. This is in view of MPEP §2142, which states that to establish a *prima facie* case of obviousness,

> "there must be some suggestion or motivation either in the references themselves or in the knowledge generally available to one of ordinary

skill in the art, to modify the references or to combine reference teachings"

Moreover, in the hindsight case, the teaching or suggestion to make the claimed combination must be found in the prior art and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

The primary reference (**Akkapeddi**) teaches a phase conjugator that utilizes a pump laser, a non-linear crystal, and a Raman amplifier as part of a system to return a phase conjugated interrogating laser beam back to a source. Akkapeddi addresses the issue of two-dimensional spatial phase conjugation for communicating through the atmosphere (i.e. to correct for atmospheric turbulence, [see first line of Akkapeddi's abstract, "An improved adaptive optics system is disclosed for correcting atmospheric phase aberrations"]), but is based on different physical phenomenology as opposed to Appellant's invention, i.e., Akkapeddi does not suggest or disclose Appellant's claimed plurality of **broad area, intra-cavity** phase conjugators arranged in an array.

The secondary reference, i.e., **Vasil'ev**, teaches the generation of a self-pumped non-collinear four wave mixing signal inside a broad area semiconductor laser diode (SLD) (i.e. a diode laser that lacks lateral confinement) in an external cavity configuration. The self-pumped four wave mixing signal is generated in a 'spatially non-degenerate configuration", i.e., at an angle with respect to the pump beams so that it can be separated from the pump beams and fed back from an external mirror. Self-seeding of this type is a means to control the longitudinal mode characteristics (operating frequency characteristics) of a laser. The arrangement described in Vasil'ev exploits the temporal phase conjugation properties of the four-wave mixing process but is not compatible with true two-dimensional spatial phase conjugation to remove atmospheric distortions of the input probe beam as taught by Akkapeddi.

Pepper et al., describes a pseudo phase conjugator (i.e., an external retro-reflector that does not perfectly conjugate the transmitted beam, see Column 4, lines 4-6

and lines 33-38) that is capable of being arranged in an array. However, Pepper et al. does not teach or suggest the broad area intra-cavity phase conjugator claimed by Appellant nor is there any motivation, suggestion or teaching to combine Pepper with either Akkapeddi and Vasil'ev to comprise Appellant's claimed invention.

Thus, neither Akkapeddi,Vasil'ev, or Pepper et al. teaches or suggests any benefits, which may be derived from the combination. On the contrary, as shown by the expressed statement by Vasil'ev et al. on page 42, in the second to last paragraph, and as discussed infra, Vasil'ev expressly teaches away from such a combination and would destroy a primary intended function such as that taught by Akkapeddi.

Accordingly, Appellant respectfully submits that neither Akkapeddi, Vasil'ev, nor Pepper et al. teaches or suggests a combination to motivate one of ordinary skill in the art to make such a combination so as to produce a broad area intra-cavity device provided by Appellant. In light of want of such a combination, a 103(a) rejection is deemed improper and should be removed.

A2. <u>Vasil'ev et al. Teaches Away from the Claimed Invention</u>

In support of the obviousness rejection, the Examiner stated, as discussed above that "Vasil'ev et al. teaches a broad area, intra-cavity phase conjugator (Figures 1a and 1b; columns 1-3) <u>which may be used in a system to produce a phase conjugate beam</u> such as the system disclosed by Akkapeddi." Appellant respectfully submits that the Examiner erred in reading the language of Vasil'ev et al. with respect to producing a phase conjugate beam which may be used in a system, such as disclosed by Akkapeddi.

> Under MPEP §2145 (X)(D)(2): "[i]t is improper to combine references where the references teach away from their combination." *In re Grasselli*, 713 F.2d 731, 743, 218 USPQ 769, 779 (Fed. Cir. 1983)

Again, the primary reference (Akkapeddi) addresses communication through the atmosphere by correcting for turbulence aberrations with his phase conjugation

system (See first line of Akkapeddi's abstract, "An improved adaptive optics system is disclosed for correcting atmospheric phase aberrations"). Vasil'ev teaches that **SLD's** (i.e., Semiconductor Laser Diodes that are taught in his apparatus) **are not suitable for turbulence aberration correction**. In fact, the authors in Vasil'ev expressly state, "It should be noted that strictly speaking the "conjugate " signal generated is not the "phase conjugate" of the input beam, because of the "filtering" action of the waveguide of the SLD. In view of this SLD's are not truly suitable for turbulence aberration correction.....".

The mere fact that references can be combined or modified does not render the resultant combinations obvious unless the prior art also suggest the desirability of the combination. Clearly, as stated in the abstract portion of Akkapeddi, correcting for atmospheric phase aberrations is an important feature. It seems beyond rational argument, therefore, that the disclosure in Vasil'ev, which teaches that his devices are not truly suitable for correcting such aberrations, is a device that one of ordinary skill in the art would find desirable to combine with a system, such as that disclosed by Akkapeddi, which requires such a correction. In fact, when read in context, the teaching of Vasil'ev is understood to exclude applications such as that taught by Akkapeddi.

A3. The References are Not Properly Combinable or Modifiable because their Intended Function is Destroyed

In addition to the aforementioned arguments of non-obviousness, Appellant respectfully submits that the rejection also fails the obviousness test because the combination of the cited references would destroy their intended function. The CCPA and the Federal Circuit have consistently held that:

> "when a §103 rejection is based upon a modification of a reference that destroys the intent, purpose or function of the invention disclosed in the reference, such a proposed modification is not proper and the

prima facie case of obviousness can not be properly made." *In re* Gordon, 733 F. 2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

Again, like Appellant's invention, the primary reference Akkapeddi addresses the issue of two-dimensional spatial phase conjugation for communicating through the atmosphere but is based on different physical phenomenology as opposed to Appellant's invention (i.e., Akkapeddi does not suggest or disclose the claimed **broad area, intra-cavity** phase conjugator). By contrast, the arrangement described in Vasil'ev exploits **temporal** phase conjugation properties of the four-wave mixing process but **does not disclose or suggest** true **two-dimensional spatial phase conjugation to remove atmospheric distortions** of the input probe beam as taught by Akkapeddi. To make the Examiner's proposed obvious modification to produce Appellant's claimed invention, i.e., taking the system described in Vasil'ev and simply replacing Akkapeddi's nonlinear crystal phase conjugator and Raman amplifier with Vasil'ev's apparatus, would render Akkapeddi's overall **purpose, intent, and function** of producing a ***spatially*** phase conjugated beam system to remove atmospheric distortions inoperable (see similar discussions in A1 and A2). Thus, it would be improper to combine such references as directed under the holding of *In re* Gordon to formulate a 103(a) obviousness rejection.

A4. Conclusion

Accordingly, Appellant respectfully submits that there is nothing in any of the cited references to provide a suggestion or motivation in support of the combination of references cited, the references teach away from their combination, and furthermore, if combined, the combination of the references would destroy the intended purpose and function of the primary reference (Akkapeddi). Therefore, Appellant respectfully submits that the 35 U.S.C. §103(a) rejection of the claims is improper in light of the afore-mentioned arguments and should be reversed.

B. Appellant's claims 8 and 15 are Not Obvious over Akkapeddi in view of Vasil'ev et al. and Pepper et al. and further in view of Watanabe

Claims **8** and **15,** stand rejected under 35 U.S.C. §103(a) as being unpatentable over Akkapeddi in view of Vasil'ev et al and Pepper et al. as applied to claim 1 above, and further in view of Watanabe (US 5,920,588 A). To support the rejection, the examiner states, "[I]t would have been obvious to a person of ordinary skill in the art to use a single gain stripe device as taught by Watanabe in the system described by Akkapeddi in view of Vasil'ev et al. and Pepper et al. as an engineering design choice of a nonlinear medium for producing the phase conjugate beam already disclosed.

Appellant respectfully submits, that similar to the reasons developed in Section A for combining Akkapeddi and Vasil et al., the obviousness rejection of claims 8 and 15 is improper and should be reversed.

Moreover, the Watanabe work is based on the use of intra-cavity four-wave mixing and phase conjugation for the purpose of removing the effects of chromatic dispersion and pulse distortion in fiber communication systems and **<u>not</u> for producing a spatially conjugated beam**. For example Watanabe states, (See Column 16, lines 17-20), "An optical fiber 2 is optically connected through a lens 3 to a first end of a DFB laser diode 1, and an optical filter 10 is optically connected through a lens 6 and an optical fiber 4 to a second end of the DFB laser diode 1." As another example, Watanabe claims (See claim 63) "A device,...wherein said optical fiber has a zero-dispersion wavelength substantially equal to a wavelength of said pump light." Watanabe in essence teaches and claims an intra-cavity four-wave mixing in a single-mode DFB laser waveguide that would spatially filter an atmospherically aberrated input beam, destroying the spatial information required to produce a spatially phase conjugated retro-beam. Such a device does not correct for atmospheric distortions as taught in Akkapeddi. Furthermore, the Examiner seeks to combine Pepper et al. because of a plurality of phase conjugators disclosed in Pepper et al. being arranged in an array.

However, in light of the preceding arguments with respect to Akkapeddi, Vasil'ev and Watanabe, Pepper et al. in addition to such refrences neither individually or combined does not support an obvious combination of claim elements as defined by Appellant's claims within the meaning of 35 USC 103(a) .

Therefore, it is **not an engineering design choice** as stated by the examiner to use a single gain stripe as taught by Watanabe in the system described by Akkapeddi because to do so would not enable atmospheric distortions to be corrected, which is a desired intent and function of the Akkapeddi apparatus, as discussed above in Section A.

Accordingly, the rejection of claims 8 and 15 under 35 U.S.C. §103(a) is improper and is requested to be reversed.

C. Appellant's claims 18, 19, and 21 are Not Obvious over Akkapeddi in view of Vasil'ev et al.

Similarly, for the reasons developed above in Section A, Appellant respectfully submits that the obviousness rejection under 35 U.S.C. §103(a) of claims **18**, **19**, and **21** is inappropriate and is requested to be reversed. In particular, no suggestion or motivation is present in the art to combine the Akkapeddi and Vasil'ev et al. references with Vasil'ev et al. teaching away from the combination and with Vasil'ev et al. destroying the intended function of the Akkapeddi reference.

D. Appellant's claims 20 and 46-49 are Not Obvious over Akkapeddi in view of Vasil'ev et al. and Pepper et al. as applied to claim 1 or as applied to claim 18

Similarly, for the reasons developed above in Section A, Appellant respectfully submits that the obviousness rejection under 35 U.S.C. §103(a) of claims **20**, and **46-49** is inappropriate and is requested to be reversed. In particular, no suggestion or motivation is present in the art to combine the Akkapeddi and Vasil'ev et al. references with Vasil'ev et al. teaching away from the combination and with Vasil'ev et al. destroying the intended function of the Akkapeddi reference.

E. **Appellant's claims 22 and 23 are Not Obvious over Akkapeddi in view of Vasil'ev et al. and Damen et al.**

Similarly, for the reasons developed above in Section A, Appellant respectfully submits that the obviousness rejection under 35 U.S.C. §103(a) of claims **22** and **23** is inappropriate and is requested to be reversed. In particular, no suggestion or motivation is present in the art to combine the Akkapeddi and Vasil'ev et al. references with Vasil'ev et al. teaching away from the combination and with Vasil'ev et al. destroying the intended function of the Akkapeddi reference.

F. **Appellant's claims 24 and 26-33 are Not Obvious over Watanabe in view of Vasil'ev et al. and Macdonald**

Claims 24, 26-33 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Watanabe in view of Vasil'ev et al. and MacDonald (U.S. Patent No. 5,519,723 A). The Examiner states that, "Watanabe discloses an optical interconnection system (Figure 2) comprising: a fiber device (fiber 2) constructed to transmit an interrogating beam (omega s) to a predetermined intra-cavity phase conjugator 1." In addition, the examiner states that, "[i]t would have been obvious to a person of ordinary skill in the art to use a mirror taught by MacDonald in the system disclosed by Watanabe….[i]t would have been obvious to a person of ordinary skill in the art to use the broad area phase conjugator taught by Vasil'ev et al. as the phase conjugator in the system suggested by Watanabe in view of MacDonald as an engineering design choice of a phase conjugating medium." Appellant respectfully traverses the rejection.

Appellant respectfully submits that the 103(a) rejection is improper for want of prima facie support of obviousness because neither the Watanabe reference, Vasil'ev, nor the MacDonald reference, either individually or combined, show an obvious combination of claim elements as defined by Appellant's claims within the meaning of 35 USC 103(a). As shown in Section A above, under MPEP §2142, to establish a *prima facie* case of obviousness,

"there must be some suggestion or motivation either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the references or to combine reference teachings"

In addition, under MPEP §2142, to establish a prima facie case of obviousness: "there must be a reasonable expectation of success"

MacDonald (See abstract) utilizes a phase conjugate mirror arranged as one mirror of a confocal resonator. The Watanabe work is based on the use of intracavity four-wave mixing and phase conjugation for the purpose of **removing the effects of chromatic dispersion** and pulse distortion in fiber communication systems. It is in essence a one-dimensional phase conjugator (correcting for wavelength dependent timing distortions) that relies on single spatial mode operation. Vasil'ev et al. **exploits the temporal phase conjugation properties** of the four-wave mixing process. Appellant submits that there is not a teaching or suggestion in either MacDonald, Watanabe or Vasil'ev et al. that warrants the combination. In addition, to substitute features from the Vasil'ev et al. system into the Watanabe reference systems would not have any reasonable expectation of success and therefore not be merely a design choice because the features chosen in the respective references were chosen to produce the respective effects of removing chromatic dispersion effects (Watanabe), or exploiting temporal phase conjugation properties (Vasil'ev et al.). It necessarily follows that the mirror as taught in MacDonald would not be utilized in a reference such as Watanabe that neither teaches, suggests or motivates one of ordinary skill in the art to utilize the embodiments of Watanabe in a confocal resonator design as disclosed in MacDonald and then make a further combination with Vasil'ev et al.

Accordingly, the rejection of claim **24** and claims **26-33** under 103(a), which depend on claim 24 is deemed improper and is requested to be reversed.

G. Appellant's claims 25 is Not Obvious over Watanabe in view of Vasil'ev et al. and Macdonald as applied to claim 24, and further in view of Damen et al.

Claim **25** stands rejected under 35 U.S.C. §103(a) as being anticipated by Watanabe in view of Vasil'ev and MacDonald and further in view of Damen et al.

Damen et al discloses a nonlinear active gain medium employed in an optical image processor. For example, Damen et al (See abstract) states, "An optical image processor includes a nonlinear gain medium for recording an interference pattern that corresponds to the Fourier transform of an input image or the multiplicative product of the Fourier transforms of two respective input images." As one embodiment, Damen et al discloses a VCSEL structure in a four-wave mixing configuration but not as a phase conjugator in a broad area intra-cavity device configuration as disclosed by Applicant. For example, on column 3, lines 46-40, Damen et al states, "One class of optically pumped semiconductor materials that may be employed is a vertical-cavity surface-emitting laser (VCSEL) structure operating below its threshold."

Similar to the arguments made in Section F above, Appellant respectfully submits that the obviousness rejection under 35 U.S.C. §103(a) of claim 25 is improper and is requested to be withdrawn. In particular, no suggestion or motivation is present in either the Watanabe reference, the Vasil'ev, the MacDonald reference, or the Damen et al. reference, either individually or combined to show an obvious combination of claim elements as defined by Appellant's claims within the meaning of 35 USC 103(a). Moreover, under MPEP §2143.01,

> "If an independent claim is nonobvious under 35 U.S.C. §103, then any claim depending therefrom is nonobvious." In re Fine, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988).

Accordingly, in light of the above arguments for the rejection of claim 24 as discussed in Section F, the rejection of claim 25 under 35 U.S.C. §103(a) which depends on claim 24 is deemed improper and is requested to be withdrawn.

H. Appellant's claims 34 and 35 is Not Obvious over Sharp et al. in view of Vasil'ev et al.

Claims 34 and **35** stand rejected under 35 U.S.C. §103(a) as being unpatentable over Sharp et al. in view of Vasil'ev et al. This rejection is respectfully traversed.

Regarding claim **34**, the Examiner states: "Sharp et al. do not specifically disclose that the means for returning a phase conjugate beam is a broad area intracavity phase conjugator, but Vasil'ev et al. teach a broad area intracavity device for returning a phase conjugate beam such as disclosed by Sharp et al." She then states, "[i]t would have been obvious to a person of ordinary skill in the art to use a broad area intracavity phase conjugator taught by Vasil'ev et al. in the system disclosed by Sharp et al. as an engineering design choice of a way to provide a phase conjugate beam without requiring a separate source of pump light."

The primary reference (**Sharp et al.**) teaches a phase conjugation arrangement that **corrects for atmospheric turbulence** (see lines 30-32, column 6, "The instant invention is also not substantially dependent on environmental conditions") by utilizing a photorefractive material, and requires two external pump sources coupled with optical modulators to provide the encoding necessary to provide the gratings established in the photorefractive materials while the opposite pump sources read the gratings and supply the energy for the production of the conjugate wave. Vasil'ev et al. as discussed above in Section A, teaches the generation of a self-pumped non-collinear four wave mixing signal inside of a broad area semiconductor laser diode (SLD) (i.e. a diode laser that lacks lateral confinement) in an external cavity configuration.

Appellants respectfully submit that similar to the arguments discussed above in section A, there is not teaching or suggesting in either Sharp et al. or Vasil'ev et al. of making such a combination. Vasil'ev teaches away from being combined with such a disclosure as shown in Sharp et al. and Vasil'ev et al if combined with Sharp et al. essential destroys the intended purpose and function of Sharp et al. eliminate deleterious environmental effects. Thus, Appellant respectfully submits that such an argument that the Examiner extends, i.e., that is merely a design choice, is in error because the features chosen in the respective references were chosen to produce the respective effects of removing spatial effects (Sharp et al.) or exploiting temporal phase conjugation properties (Vasil'ev et al.).

Accordingly, the rejection of claims 34 and 35 under 35 U.S.C. §103(a) is deemed improper and is requested to be withdrawn.

I. <u>Appellant's claims 36-39 is Not Obvious over Sharp et al. in view of Pepper et al. and Vasil'ev et al.</u>

Claims 36-39 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Sharp et al. in view of Pepper et al. and Vasil'ev et al. This rejection is respectfully traversed.

The examiner makes similar arguments in her rejection of claims 36-39 as were made in the rejection of claims 34 sand 35 under 35 U.S.C. §103(a) but adds the reference (Pepper et al.) and states that Pepper et al., "teach that a plurality of phase conjugators arranged in an array may be used in a system to produce a phase conjugate beam as in the method disclosed by Sharp et al.". The examiner also states, that it would have been obvious to a person of ordinary skill in the art to specifically use a broad area intracavity phase conjugator as Vasil'ev et al. teach in the method disclosed by Sharp et al. as a known engineering choice..."

In light of similar arguments developed above in Section H, Appellant respectfully submits that the obviousness rejection under 35 U.S.C. §103(a) of claims 36-39 is inappropriate and should be removed.

J. Appellant's claims 42-44 is Not Obvious over Pepper et al. in view of Vasil'ev et al.

Claims 42-44 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Pepper et al. in view of Vasil'ev. This rejection is respectfully traversed. The Examiner states with regard to claim 42 that "Pepper et al. disclose a method of providing an optical interconnect, comprising:

transmitting an interrogating beam from a fiber optic device;

receving the interrogating beam at a micro-mirror 16 across free space;

transmitting a second beam from the micro-mirror; and

producing a phase conjugate beam or the second beam received from the micro-mirror by a predetermined phase conjugator 12.

In addition, the examiner states that Pepper et al. do not specifically disclose a broad area intracavity phase conjugator, but Vasil'ev et al. teach a broad area intracavity phase conjugator." The Examiner then states, "[i]t would have been obvious to a person of ordinary skill in the art to use the phase conjugator taught by Vasil'ev et al. as the phase conjugator in the system disclosed by Pepper et al as an engineering design choice..."

Appellants respectfully submit that neither **Pepper et al.** nor **Vasil'ev et al.**, either individually or combined, teach or suggest all the claim limitations as mandated under MPEP §2142 to fall within the meaning of 35 USC 103(a). MPEP §2142 states as one prong of the obviousness test that to establish *a prima facie case* of obviousness:

> "The prior art reference (or references when combined) must teach or suggest all the claim limitations."

Appellant respectfully submits that Pepper et al. does not show a single step having the respective claim limitations as shown in claim 42 above, i.e., transmitting an interrogating beam from a fiber optic device, receiving the interrogating beam at a micro-mirror, transmitting a second beam from the micro-mirror, etc. as stated by the Examiner. It is therefore believed that the Examiner erred in reading the language of Pepper et al. and then combining the reference with Vasil'ev et al. to formulate a 103(a) rejection.

Accordingly Appellant respectfully submits that the rejection of claims 42-44 under 35 U.S.C. §103(a) is deemed improper and is requested to be withdrawn.

IX. SUMMARY

Accordingly, Appellant respectfully submits that claims 1-49 distinguish patentably over the cited references and the rejections should be reversed. Thus, Reconsideration and allowance of claims 1-49 is respectfully requested.

Respectfully submitted,

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Registration No. 50,938
Telephone No. (925) 422-3682

Dated: 2/20/04

Attachments:

Appendix I (Appealed Claims)

Appendix II (Drawings)

APPENDIX I
S.N. 09/827,454
CLAIMS ON APPEAL

1. A system comprising:

a transceiver constructed to transmit an interrogating beam;

a communications station capable of receiving said interrogating beam; and

said communications station having a plurality of broad area intra-cavity phase conjugators arranged in an array.

2. The system of claim 1, further comprising:

said communication station capable of transmitting an encoded phase conjugate beam to said transceiver from said plurality of phase conjugators.

3. The system of claim 1, wherein said communication station is configured to respond to said interrogating beam by encoding data into a phase conjugate beam in a plurality of semiconductor laser diodes and pumping the encoded phase conjugate beam by intracavity nondegenerate four wave mixing.

4. The system of claim 3, wherein said encoding of said phase conjugate beam is accomplished at rates exceeding approximately 1 kiloHertz.

5. The system of claim 3, wherein said encoding of said phase conjugated beam is accomplished at rates in the range of approximately 1GHz to approximately 10 GHz.

6. The system of claim 1, wherein said plurality of phase conjugators are arranged in a substantially linear array.

7. The system of claim 1, wherein said plurality of phase conjugators are substantially spaced apart.

8. The system of claim 1, wherein said plurality of phase conjugators are single gain stripe devices.

9. The system of claim 1, wherein said plurality of phase conjugators number at least four.

10. The system of claim 1, wherein the plurality of intra-cavity phase conjugators each comprise an aperture sufficient to resolve a substantial portion of the spatial components of the input wavefront of the interrogating beam.

11. The system of claim 1, wherein the plurality of intra-cavity phase conjugators each comprise an aperture sufficient to resolve greater than approximately 80% of the spatial components of the input wavefront of the interrogating beam.

12. The system of claim 1, wherein the communication station does not have a movable part pointing and tracking system.

13. The system of claim 1, wherein the plurality of phase conjugators each have a top electrode with an aperture.

14. The system of claim 1, wherein the interrogating beam interacts with pump beams operating in the plurality of phase conjugators at a substantially transverse angle.

15. The system of claim 1, wherein the interrogating beam interacts with pump beams operating in the plurality of phase conjugators in a substantially parallel manner.

16. The system of claim 1, wherein the transceiver is mounted on one of the group consisting of a UAV, airplane, HALE, satellite, ground station, and an automobile.

17. The system of claim 1, wherein the communication station is mounted on one of the group consisting of a UAV, airplane, HALE, satellite, ground station, and an automobile.

18. A system comprising:

a transceiver constructed to transmit an interrogating beam; and

a communication station capable of receiving said interrogating beam; and

said communication station having a broad area, intra-cavity phase conjugator with a top electrode, wherein an aperture is located in said top electrode.

19. The system of claim 18, wherein the interrogating beam interacts with at least one pump beam operating in the phase conjugator at a substantially transverse angle.

20. The system of claim 18, wherein the phase conjugator is a broad–area, distributed feedback laser device.

21. The system of claim 18, wherein the aperture is greater than 10 microns.

22. A system comprising:

a transceiver constructed to transmit an interrogating beam;

a communication station capable of receiving said interrogating beam; and

said communication station having a broad area, intra-cavity phase conjugator which is a VCSEL structure.

23. The system of claim 22, wherein the interrogating beam interacts with at least one pump beam operating in the phase conjugator in a substantially parallel manner.

24. An optical interconnection system comprising:

a fiber optic device constructed to transmit an interrogating beam; and

a micro-mirror adapted to receive said interrogating beam and transmit the beam to a predetermined broad area intra-cavity phase conjugator.

25. The system of claim 24, wherein said intra-cavity phase conjugator is a VCSEL structure.

26. The system of claim 24, wherein said interrogating beam interacts with at least one pump beams operating in the phase conjugator in a substantially parallel manner.

27. The system of claim 24, wherein said phase conjugator has a top electrode with an aperture.

28. The system of claim 24, wherein the phase conjugator is a broad-area, distributed feedback laser device.

29. The system of claim 24, wherein the interrogating beam interacts with at least one pump beam operating in the phase conjugator at a transverse angle.

30. The system of claim 24, wherein said predetermined phase conjugator is one of a plurality of phase conjugators arranged in an array.

31. The system of claim 24, wherein said predetermined phase conjugator is one of a plurality of phase conjugators arranged in a first array of a plurality of arrays of phase conjugators.

32. The system of claim 30, wherein the plurality of phase conjugators are single gain stripe devices.

33. The system of claim 30, wherein the plurality of phase conjugators have apertures located in a top electrode.

34. A system comprising:

a means for transmitting and receiving an interrogating beam;

a communication station operatively coupled to said transmitting and receiving means, wherein the station includes a broad area intracavity phase conjugator for returning a phase conjugate beam to said transmitting and receiving means.

35. A method comprising:

transmitting an interrogating beam from a transceiver;

receiving said interrogating beam at a communication station;

producing a phase conjugate beam of said interrogating beam by a broad area intracavity phase conjugator;

encoding data onto said phase conjugate beam and pumping an encoded phase conjugate reflectivity by nondegenerate four wave mixing; and

transmitting said encoded phase conjugate beam back to the transceiver.

36. A method comprising:

transmitting an interrogating beam from a transceiver;

receiving said interrogating beam at an array of phase conjugators;

producing a phase conjugate beam of said interrogating beam, wherein each of said phase conjugators arranged in said array comprise a broad area intracavity micro phase conjugator;

modulating data onto said phase conjugate beam; and

transmitting said phase conjugate beam to said transceiver.

37. The method of claim 36, further comprising:

collecting data through a sensor located in proximity to said phase conjugators and transmitting said data to said phase conjugators.

38. The method of claim 36, wherein said interrogating beam interacts with at least one pump beam operating in each of said phase conjugators in a substantially parallel manner.

39. The method of claim 36, wherein said interrogating beam interacts with at least one pump beam operating in each of said phase conjugators in a substantially transverse manner.

40. A method comprising:

transmitting an interrogating beam from a transceiver;

receiving said interrogating beam at an array of broad area intra-cavity phase conjugators through apertures located in the top electrodes of the phase conjugators;

modulating data onto a phase conjugate beam; and

transmitting the phase conjugate beam to said transceiver.

41. A method comprising:

transmitting an interrogating beam from a transceiver;

receiving said interrogating beam at an array of broad area intra-cavity phase conjugators and resolving a substantial portion of the spatial components of the input wavefront of the interrogating beam;

modulating data onto a phase conjugate beam; and

transmitting the phase conjugate beam to said transceiver.

42. A method of providing an optical interconnect comprising:

transmitting an interrogating beam from a fiber optic device;

receiving said interrogating beam at a micro-mirror across free space;

transmitting a second beam from said micro-mirror; and

producing a phase conjugate beam of the second beam received from said micro-mirror by a broad area intracavity predetermined phase conjugator.

43. The method of claim 42,

modulating data onto said second beam at said predetermined phase conjugator;

transmitting an encoded phase conjugated beam to said micro-mirror.

44. The method of claim 43, transmitting a third beam from said micro-mirror to said fiber optic device.

45. The system of claim 1, wherein said plurality of intra-cavity phase conjugators are arranged in a two dimensional array.

46. The system of claim 1, wherein said plurality of intra-cavity phase conjugators includes:

a non-linear medium for each of said plurality of intra-cavity phase conjugators wherein said non-linear medium is adapted to produce at least two coherent pump beams; and

a means to encode said coherent pump beams.

47. The system of claim 46, wherein said nonlinear medium is a diode structure comprising a broad-area distributed feedback laser device.

48. The system of claim 18, wherein said intra-cavity phase conjugator with said top electrode includes:

a nonlinear medium adapted to produce at least two coherent pump beams; and

a means to encode said coherent pump beams.

49. The system of claim 48, wherein said nonlinear medium is a diode structure comprising a modified broad-area distributed feedback laser device.

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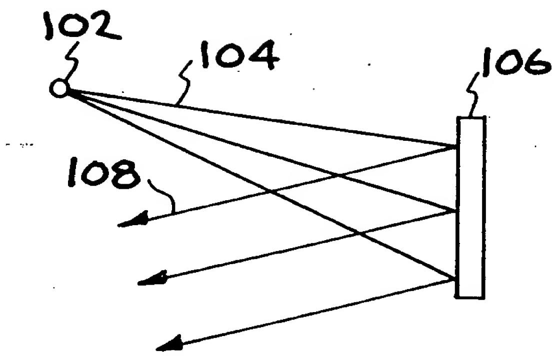

FIG. 1A

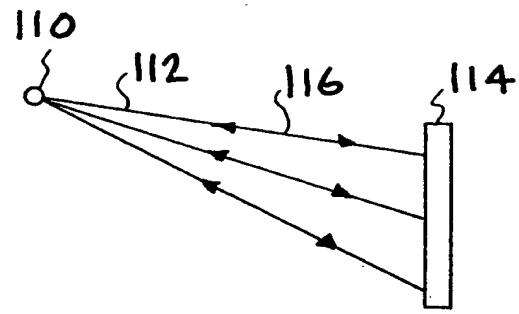

FIG. 1B

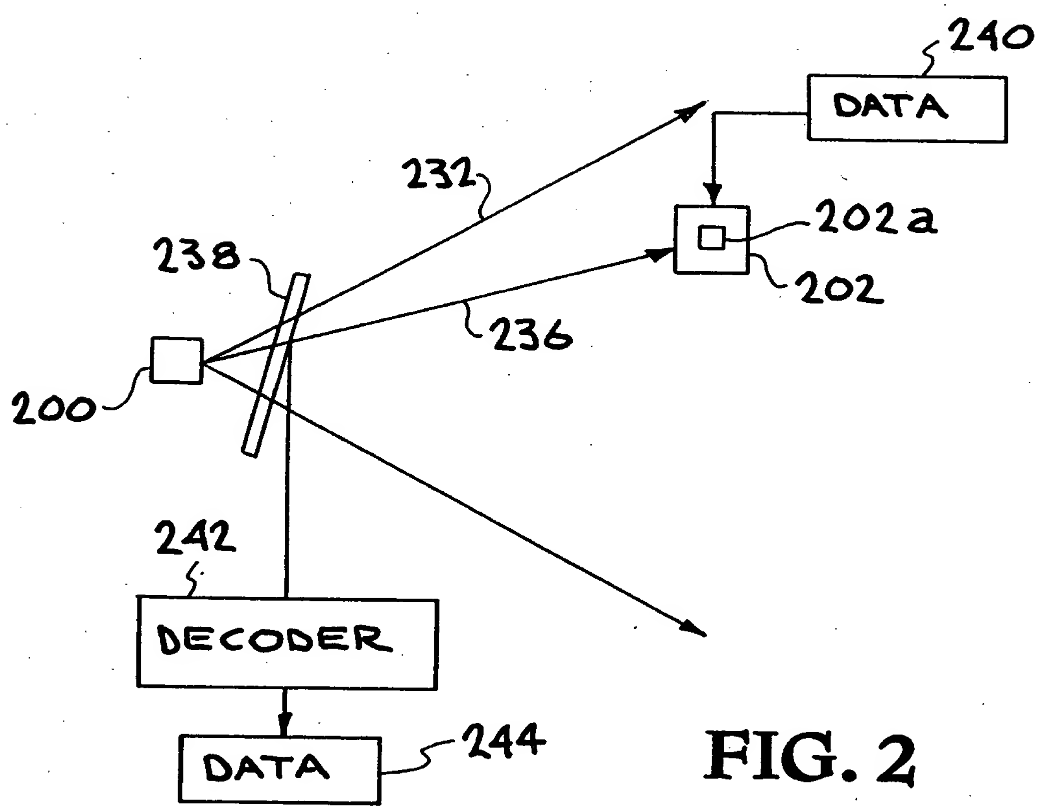

FIG. 2

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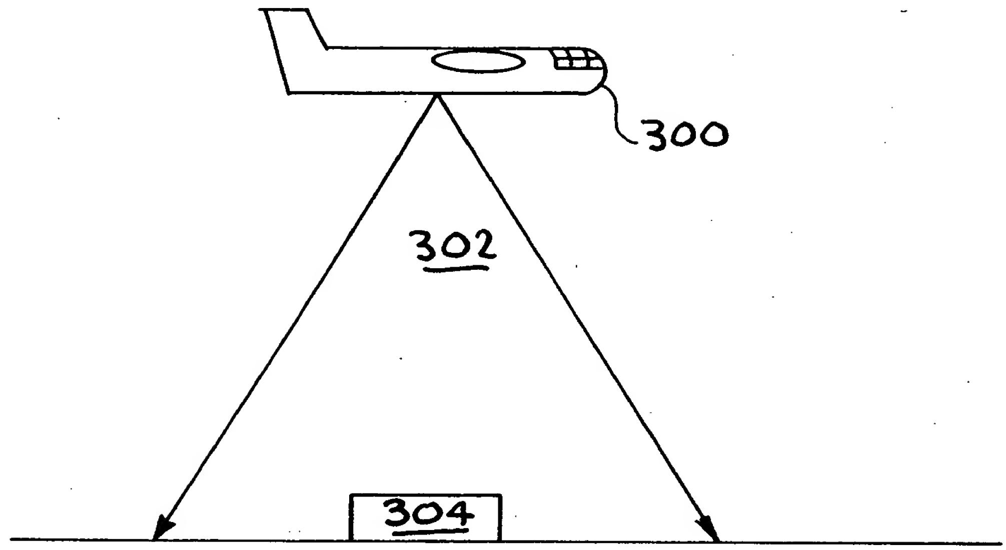

FIG. 3A

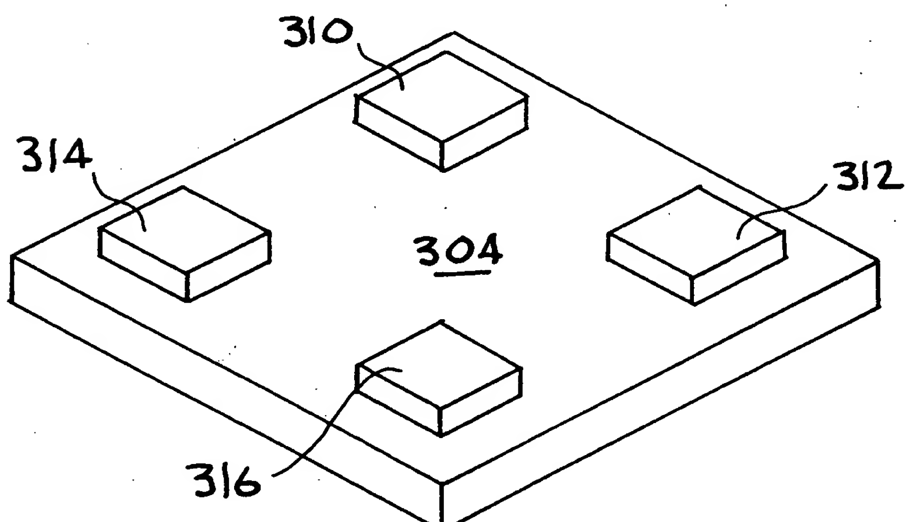

FIG. 3B

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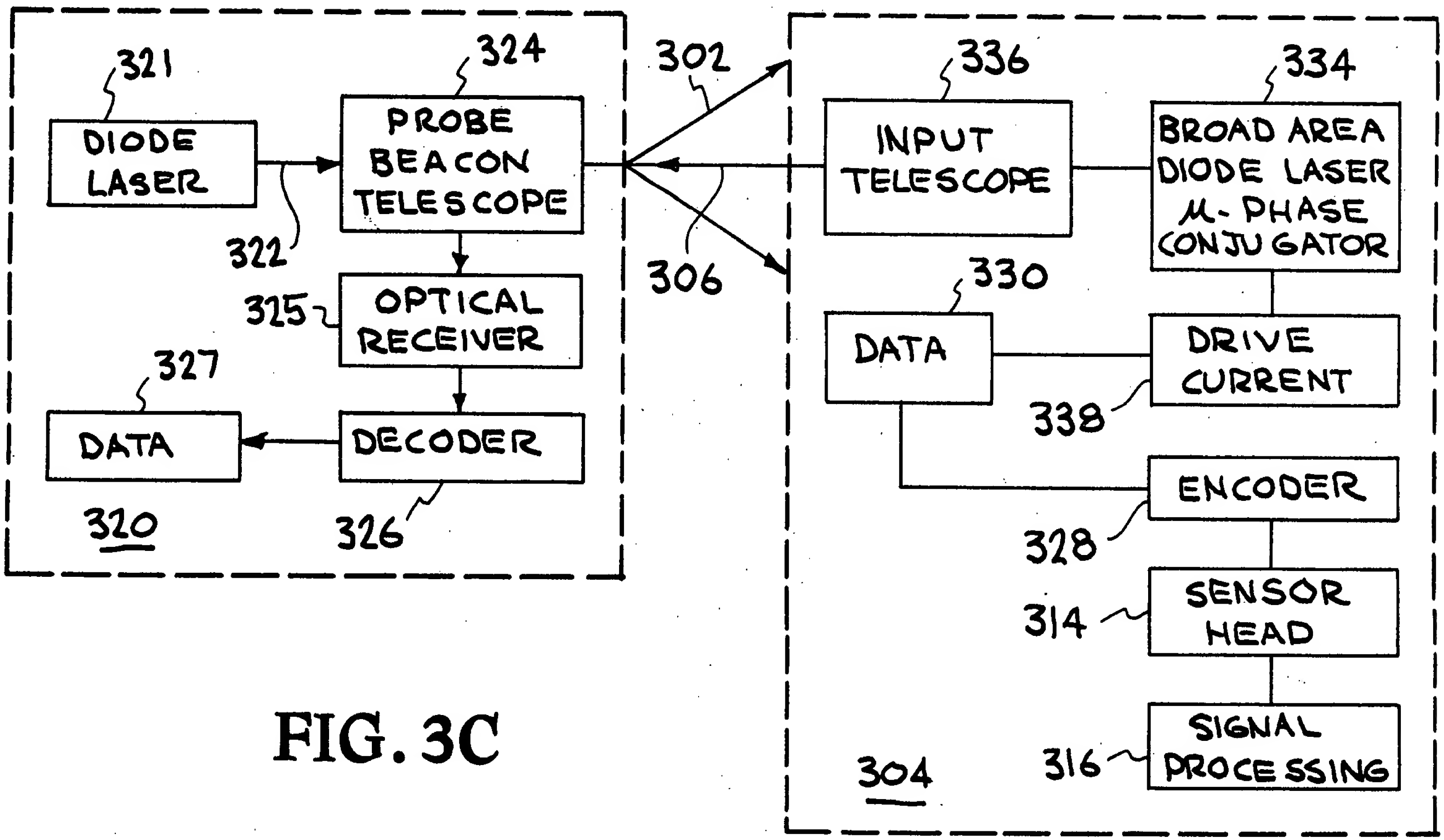

FIG. 3C

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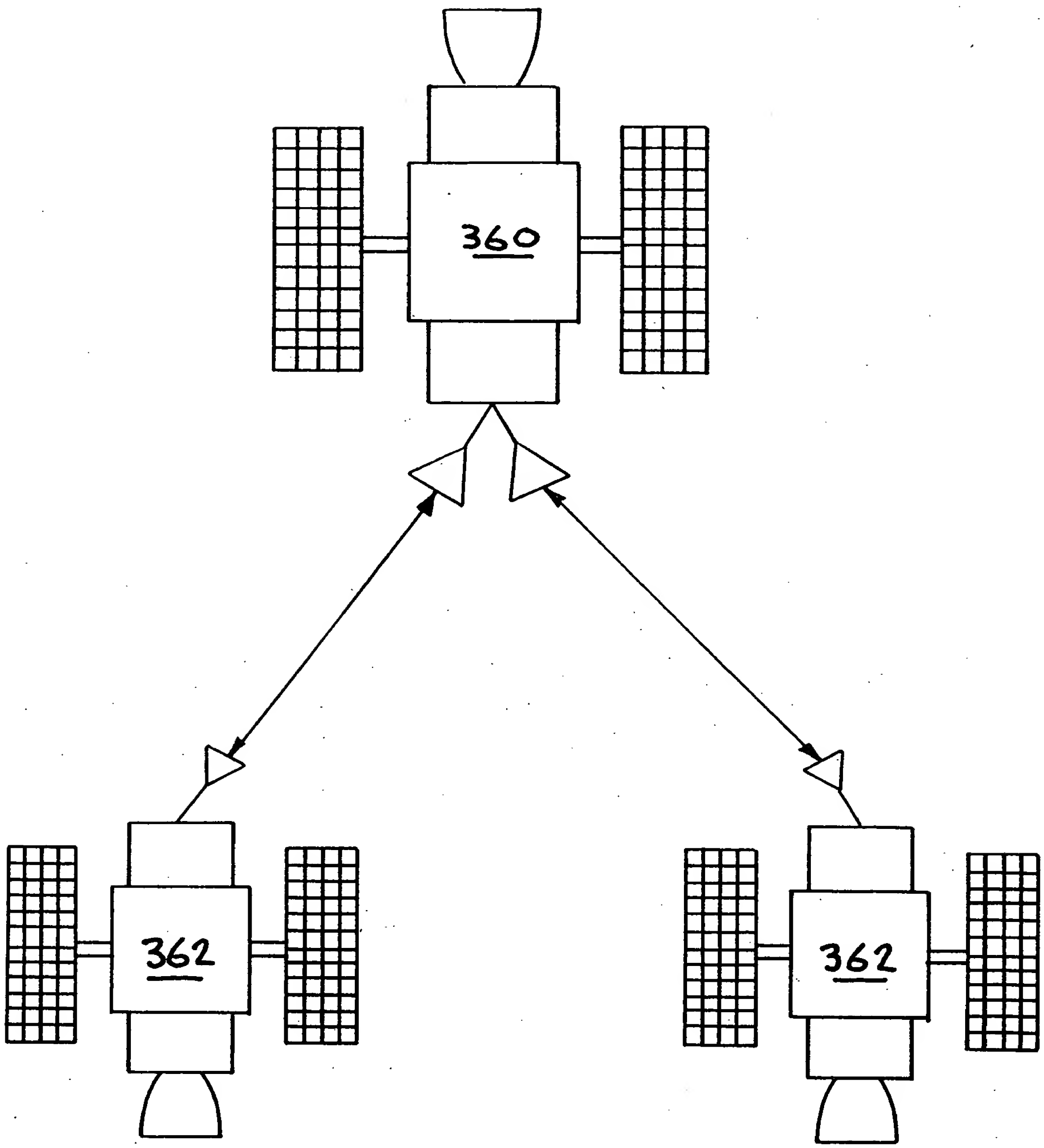

FIG. 3D

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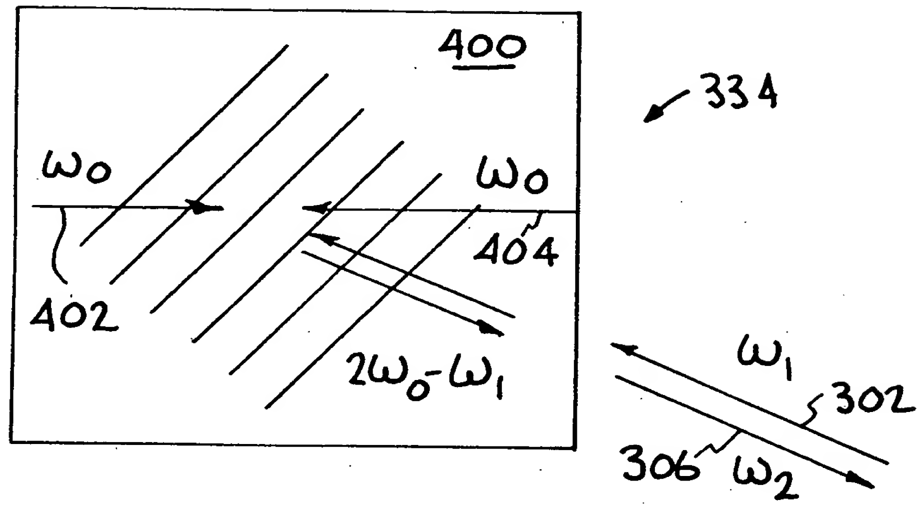

FIG. 4

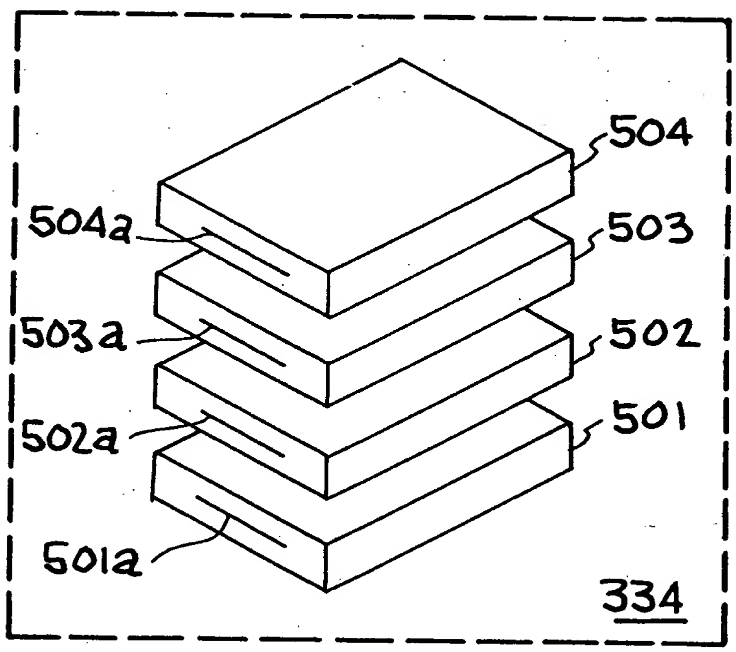

FIG. 5A

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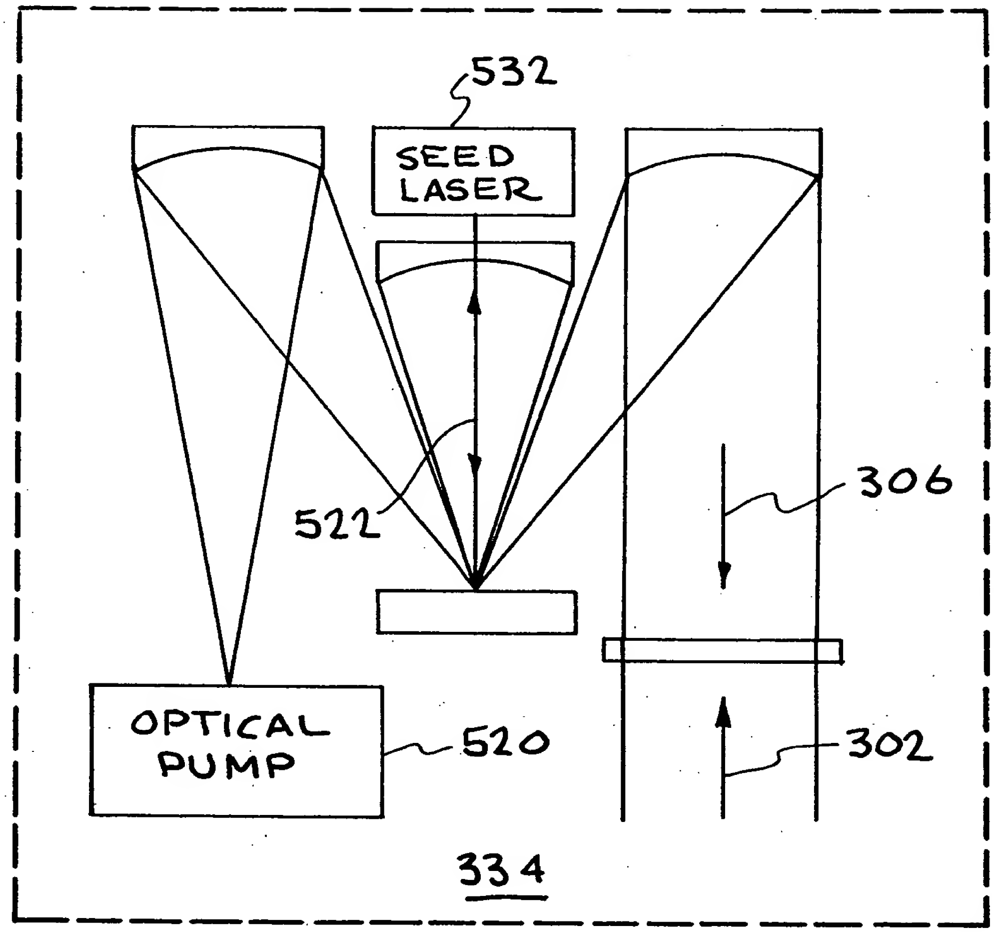

FIG. 5B

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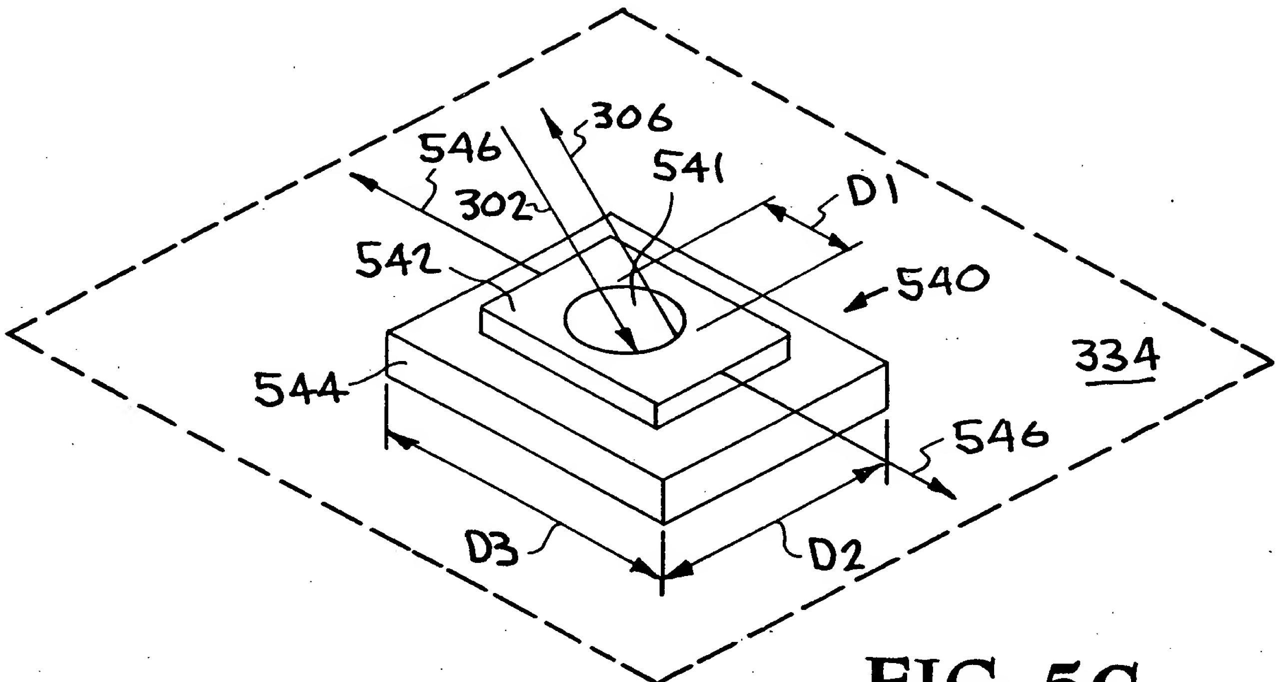

FIG. 5C

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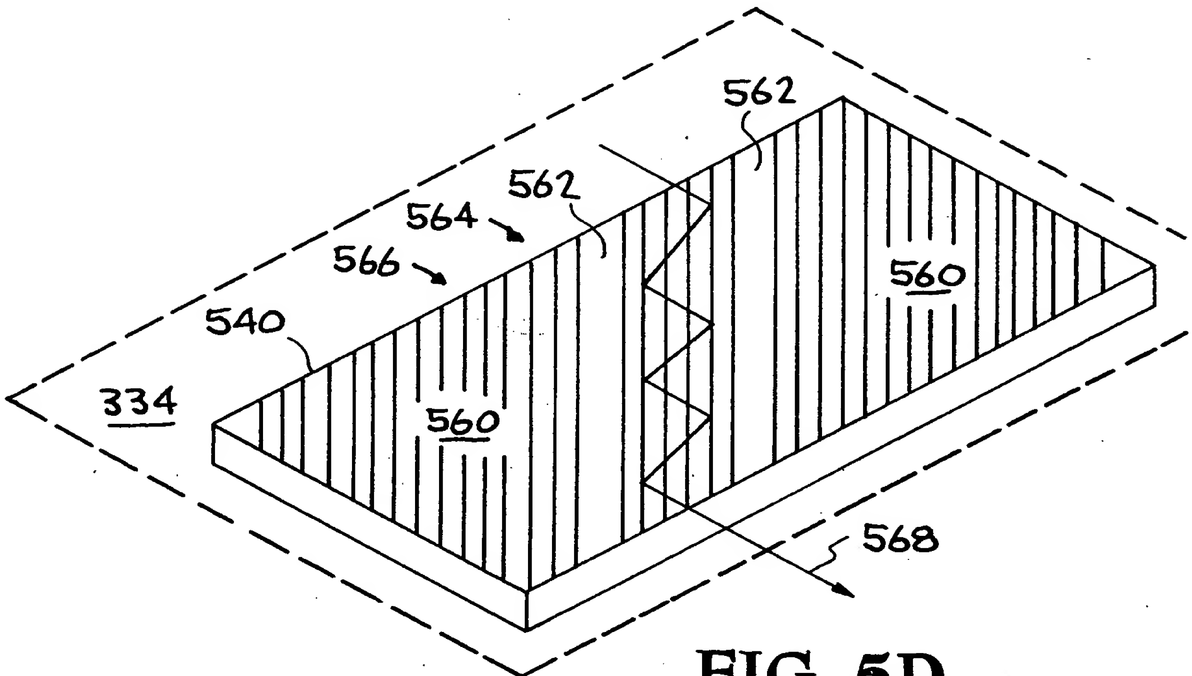

FIG. 5D

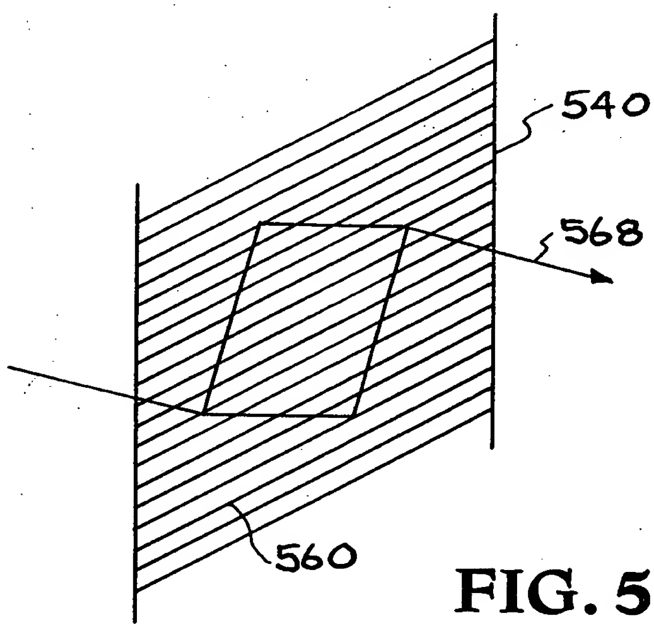

FIG. 5E

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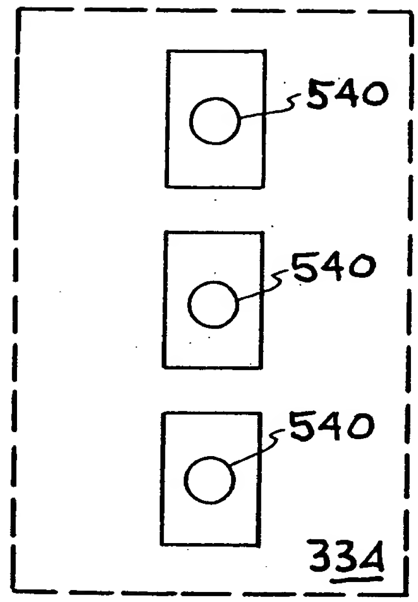

FIG. 5F

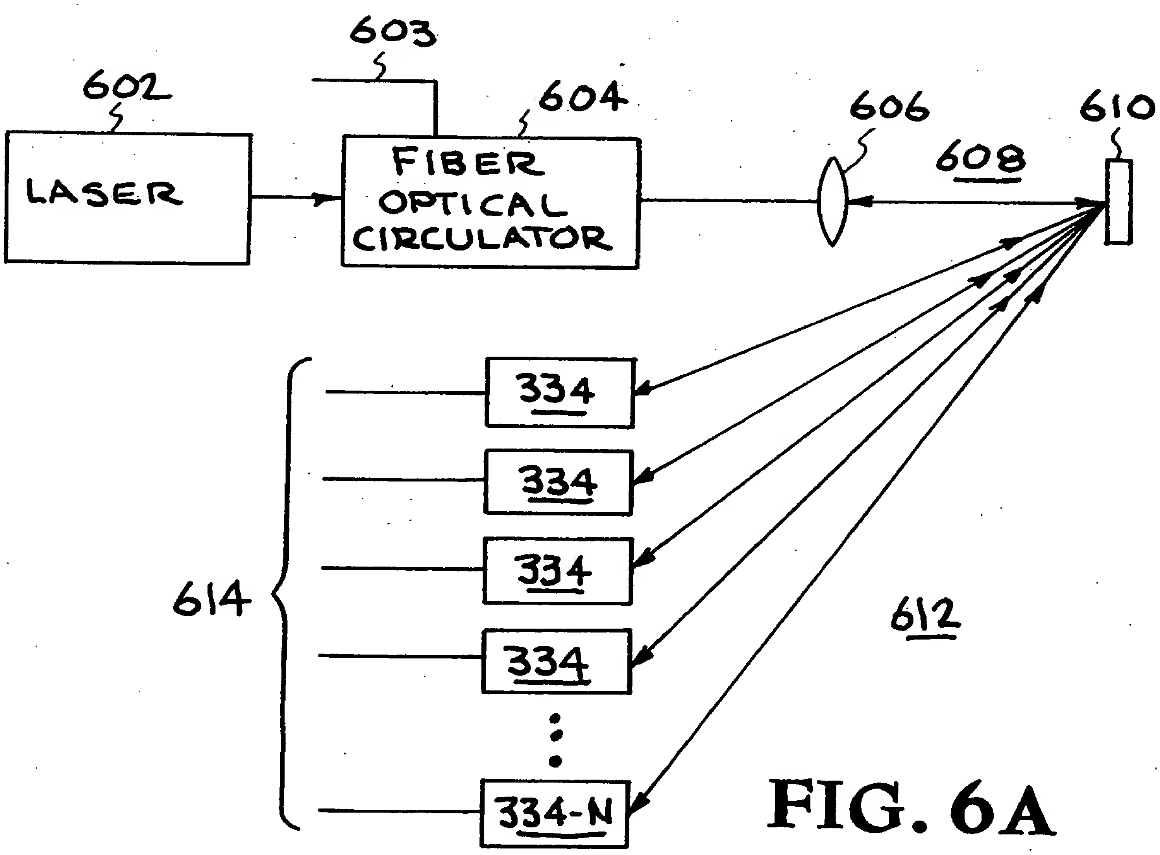

FIG. 6A

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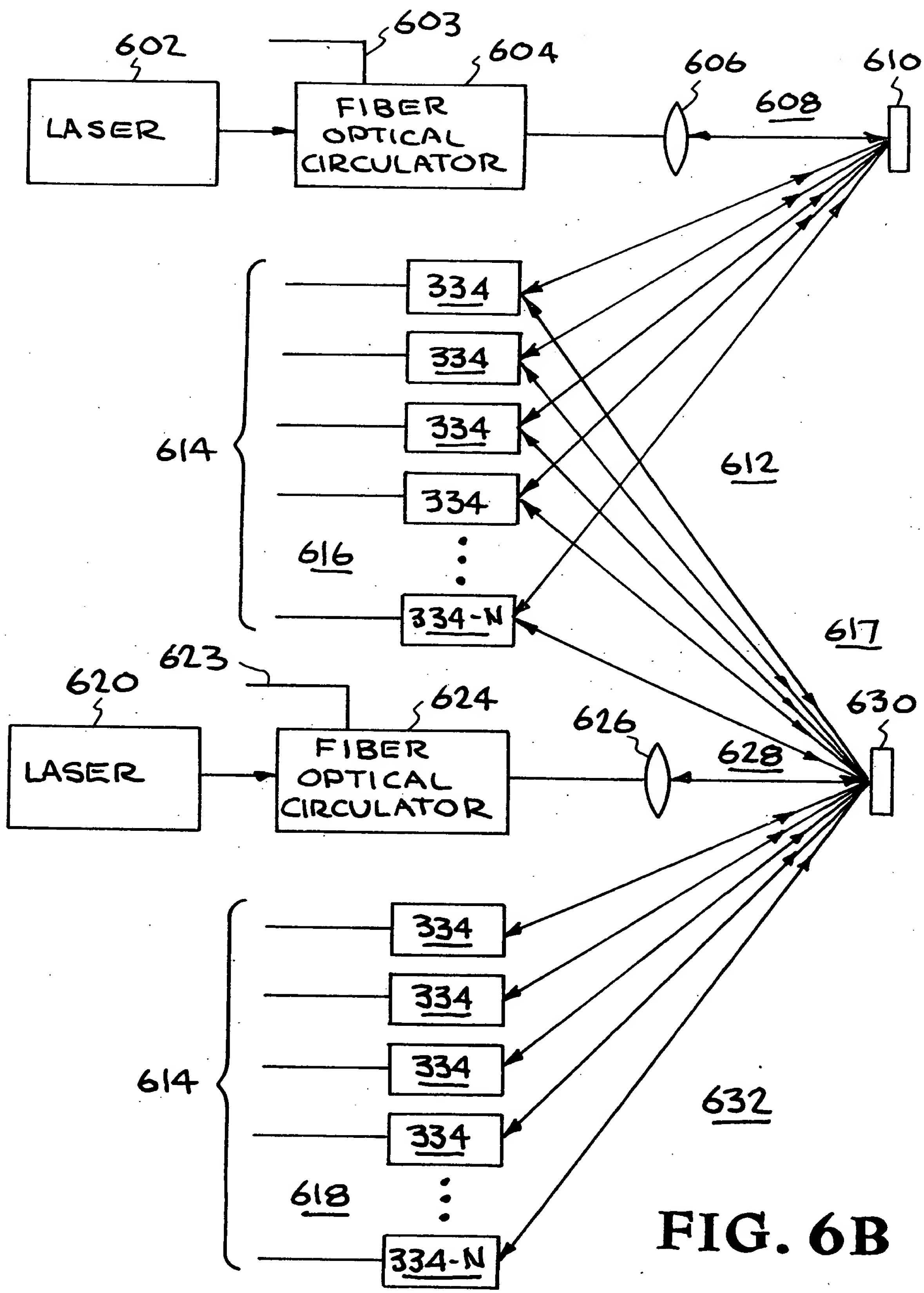

FIG. 6B